

Xylochitonidae fam.n., a new family of deep-water chitons, with descriptions of a new genus and species from New Zealand (Polyplacophora: Lepidopleurina).

K.L. Gowlett-Holmes* and A.M. Jones#

* South Australian Museum, North Terrace, Adelaide, S. Aust. 5000

Dept of Biological Sciences, The University, Dundee, DD1 4HN, Scotland

ABSTRACT

A new family of deep-water chitons, Xylochitonidae fam.n., is erected to contain a distinctive new species *Xylochiton xylophagus* gen. et sp.n. from New Zealand waters. The new family is placed in the suborder Lepidopleurina, as it has unslit insertion plates. It can be distinguished from all other families in the suborder by the lack of calcareous ornamentation on the ventral girdle, the presence of unslit insertion plates on at least the anterior valve, and by the evenly distributed aesthete groups with their erect subsidiary caps. Similarities between Xylochitonidae fam.n. and Abyssochitonidae are discussed.

INTRODUCTION

In 1988, Sirenko erected a new genus of deep-water chitons, *Ferreiraella*, which contained six species, four of which were known to live on sunken wood. Sirenko (1988) placed *Ferreiraella* in the family Lepidopleuridae (as Leptochitonidae), as it lacks insertion plates, and distinguished it from all others in the family by the lack of calcareous armature on the ventral girdle, the presence of spicules but not scales on the dorsal girdle and the form of the radula, with a bud-like process on the first lateral tooth. Sirenko (1988) recognised the possibility that his new genus was so distinct that it could require a new family. Dell'Angelo and Palazzi (1989), unaware of Sirenko's (1988) paper, erected a new genus, *Abyssochiton*, based on four of the six species included in *Ferreiraella*, and also erected a new family, Abyssochitonidae. *Abyssochiton* is a synonym of *Ferreiraella* (see Dell'Angelo and Palazzi, 1991), but the family name remains Abyssochitonidae, as per Article 40 of the International Code of Zoological Nomenclature.

Recently, Mr B. Marshall of the National Museum of New Zealand, Wellington brought to our attention specimens of a deep-water chiton collected from sunken wood from New Zealand waters. Superficially, these chitons resembled members of *Ferreiraella*, but a closer examination revealed that although they have a densely spiculate dorsal girdle and lack any calcareous armature on the ventral girdle like the latter, they possess insertion plates, lack the bud-like process on the first lateral tooth of the radula and have aesthete groups with erect subsidiary caps evenly distributed all over the tegmentum. We believe these differences are of major importance, and warrant not only the formation of a new genus to contain this unique species from off New Zealand, but a new family as well.

Here, we describe this new family, genus and species, and discuss its similarities to the Abyssochitonidae.

MATERIALS AND METHODS

The material reported here is deposited in the National Museum of New Zealand, Wellington (NMNZ), The Australian Museum, Sydney (AM), South Australian Museum, Adelaide (SAM), The Natural History Museum, London (BMNH), Los Angeles County Museum of Natural History (LACM), National Museum of Natural History, Smithsonian Institution, Washington (USNM), Muséum National d'Histoire Naturelle, Paris (MNHN) and the Royal Scottish Museum, Edinburgh (RSM). Valves and girdle samples were prepared for examination under the scanning electron microscope (SEM) as described in Jones and Gowlett-Holmes (1992), and radulae were prepared for examination under SEM after Bandel (1984).

Order Neoloricata Bergenhayn, 1955

Suborder Lepidopleurina Thiele, 1910

Diagnosis

Small to medium, ovate to elongate chitons; valves without, or with unslit, insertion plates; gills merobranchial.

Remarks

Starobogatov and Sirenko (1975) and Sirenko and Starobogatov (1977) regard the Lepidopleurida as an order in the subclass Neoloricata. Their classification includes many orders and suborders, the majority of which are poorly defined. Dell'Angelo and Palazzi (1989, 1991) follow the above classification, and recognise two suborders within the Lepidopleurida, Lepidopleurina s.s. and Afossochitonina Bergenhayn, 1955. The latter is based on the genus *Afossochiton* Ashby, 1925, which was placed in the Acanthochitonidae by Gowlett-Holmes (1987); as Dell'Angelo and Palazzi (1989, 1991) list Afossochitonina without diagnosis or discussion, we regard its status as dubious. These authors divide the suborder Lepidopleurina into two superfamilies, Mesochitonoidea Dell'Angelo & Palazzi, 1991 (= Paleolepidopleuridea Dell'Angelo & Palazzi, 1989) and Lepidopleuroidea Dell'Angelo & Palazzi, 1991 (= Neolepidopleuridea Dell'Angelo & Palazzi, 1989). Mesochitonoidea is defined as having pustules without aesthetes, or with pustules only on part of the tegmentum, and the Lepidopleuroidea is defined as having pustules with aesthetes more or less regularly over all of the tegmentum. However, members of the genus *Ferreiraella* Sirenko, 1988 (= *Abyssochiton* Dell'Angelo & Palazzi, 1989), placed in the Mesochitonoidea by Dell'Angelo and Palazzi (1989, 1991), have pustules with aesthetes distributed more or less evenly over the tegmentum (see Sirenko, 1988). In view of the poor definition and ambiguity of many of the taxa of these authors, we prefer to follow the higher classification of Van Belle (1983, 1985), which is well defined and consistent within the characters used.

The following key to the families is modified after Kaas and Van Belle (1985), Gowlett-Holmes (1987) and Dell'Angelo and Palazzi (1989, 1991). The family name Lepidopleuridae is used instead of Leptochitonidae following Dell'Angelo and Palazzi (1991), who correctly point out that the former was an accepted name prior to 1961 and therefore should be retained under Article 40 of the International

Code of Zoological Nomenclature. Pace Dell'Angelo and Palazzi (1991), however, we retain the family name *Abyssochitonidae* Dell'Angelo & Palazzi, 1989 in preference to *Ferreiraellidae* Dell'Angelo & Palazzi, 1991, in conformity to Article 40 of the Code.

Key to the families of the Suborder *Lepidopleurina*

1. Girdle with calcareous armament on underside 2
 Girdle without calcareous armament on underside 4
- 2(1). No insertion plates *Lepidopleuridae*
 Insertion plates on at least some valves 3
- 3(2). Anterior valve with insertion plate *Hanleyidae*
 Anterior valve without insertion plate *Protochitonidae*
- 4(1). No insertion plates *Abyssochitonidae*
 Anterior valve at least with insertion plate *Xylochitonidae*

Family *Xylochitonidae* fam.n.

Diagnosis

Small to medium, elongate chitons; anterior valve with unslit insertion plate, weak unslit insertion plates usually present on remaining valves; sutural laminae well developed; aesthetes in groups, evenly distributed over tegmentum, micraesthete caps erect; girdle with calcareous spicules dorsally, ventral surface naked; gills merobranchial.

Remarks

This family superficially resembles the *Abyssochitonidae*, another family of chitons that live on sunken wood, but *Xylochitonidae* fam.n. can easily be distinguished from the latter by the presence of unslit insertion plates on at least the anterior valve, by the evenly distributed aesthete groups with their erect subsidiary caps, and by the lack of a bud-like process on the inner lateral teeth of the radula. *Xylochitonidae* fam.n. can be distinguished from all other families in the suborder by the lack of calcareous ornamentation on the ventral girdle. This family contains only the type genus, *Xylochiton* gen.n.

Genus *Xylochiton* gen.n.

Type species

Xylochiton xylophagus sp.n.

Diagnosis

With the features of the family.

Etymology

Xylochiton, m., from a combination of the Greek "xylos" meaning wood, and "chiton", for chitons that live on sunken wood, referring to the habitat of the type species.

Remarks

This genus contains only the type species, *Xylochiton xylophagus* sp.n.

Xylochiton xylophagus sp.n.

(Figures 1-5)

Holotype

NMNZ M.100855, complete specimen, 20.20 x 8.25 mm, dredged in 1075-1100 m, on large waterlogged log of *Coriaria arborea* (Tree Tutu), off White Island (37°23.7'S, 177°39.5-36.6'E), E of North Island, New Zealand, by the U.S.S.R. F.V. "Kalinovo", Stn BS 924 (K01/019/81), 23 Nov. 1981.

Paratypes

NMNZ M.74996, 33 specimens, with same collection data as holotype; RSM-NMSZ 1991055, 7 specimens, with same collection data as holotype; SAM D18770, 3 specimens, with same collection data as holotype; USNM 860288, 1 specimen, with same collection data as holotype; BMNH 1991145, 1 specimen, with same collection data as holotype; AM C168568, 1 specimen, with same collection data as holotype; MNHN, 1 specimen, with same collection data as holotype; LACM 2280, 1 specimen, with same collection data as holotype; NMNZ M.86822, 1 specimen, dredged in 1045-1055 m, on wood, off Cape Egmont (38°58.5'S, 172°10.2'E), North Island, New Zealand, by F.V. "Wanaka", Stn WK5/17/86, 3 Mar. 1986; NMNZ M.84251, 1 specimen, dredged in 450-481 m, on

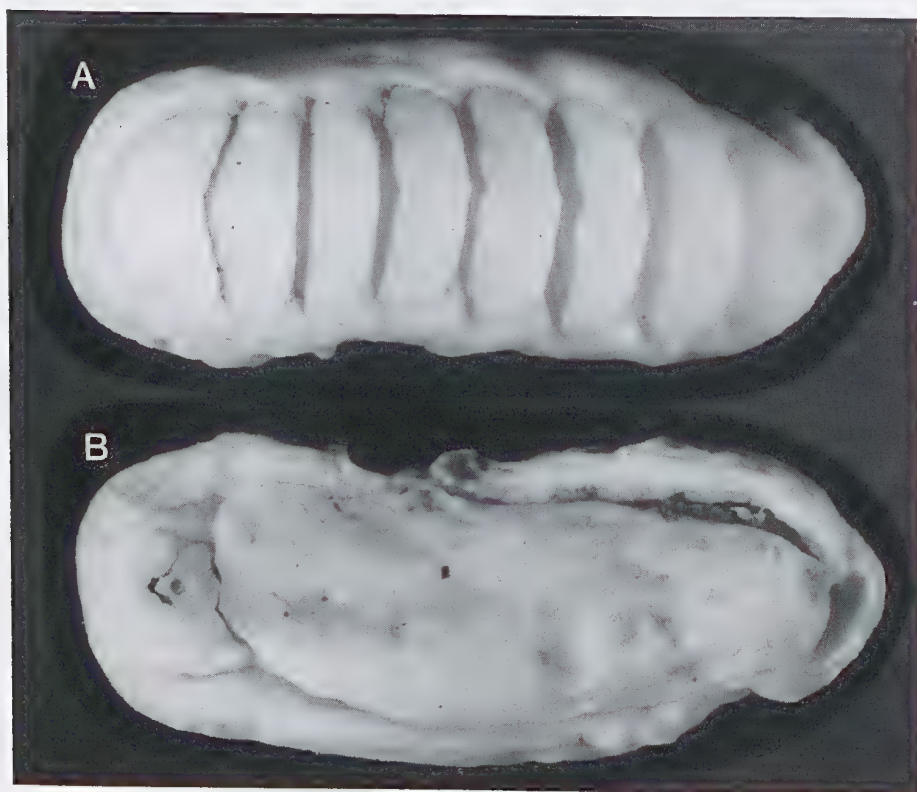


Figure 1. *Xylochiton xylophagus* sp.n. holotype (NMNZ M.100855) A. dorsal view, x 6; B. ventral view, x 6.

wood (Log A), off Cape Runaway (37°29.9'S, 177°47.0'E), North Island, New Zealand, by F.V. "Wanaka", Stn WK3/19/85, 8 Dec. 1985; NMNZ M.92446, 2 specimens, dredged in 1174-1180 m, on wood, NE of Chatham Islands (42°47.1-48.2'S, 175°45.6-47.2'E), by F.V. "Otago Buccaneer", Stn BS 931 (B01/102/84), 22 Jul. 1984.

Diagnosis

Small to medium, elongate chiton to 25 mm (Fig. 1). Rounded dorsally, low elevation (Fig. 2G); valves relatively thick, strong. Tegmentum smooth except for projecting micraesthete caps (Fig. 3C), white with darker spots at aesthete groups. Articulamentum with distinct unslit insertion plate on anterior valve, insertion plates less developed on intermediate valves, reduced to a callus on posterior valve; sutural laminae well developed; articulamentum white. Girdle white, spiculose dorsally, no calcareous ornamentation ventrally.

Species description

Anterior valve (Fig. 2A) "D"-shaped, smooth except for projecting micraesthete caps and slight concentric growth lines, stronger toward posterior margins; aesthetes in groups (Figs 3A, 3B) of 1 low megal aesthete and a semicircular arrangement of 3-8 micraesthetes with strongly projecting caps on upper side.

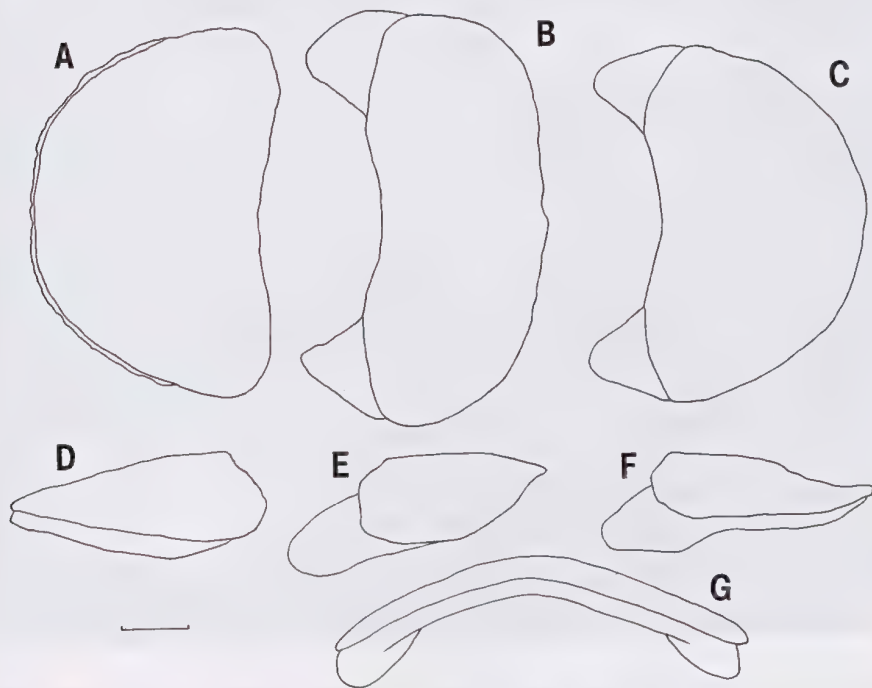


Figure 2. *Xylochiton xylophagus* sp.n. paratype (SAM D18770) A. anterior valve (dorsal view); B. intermediate valve (dorsal view); C. posterior valve (dorsal view); D. anterior valve (lateral view); E. intermediate valve (lateral view); F. posterior valve (lateral view); G. intermediate valve (posterior profile); scale bar = 1 mm.

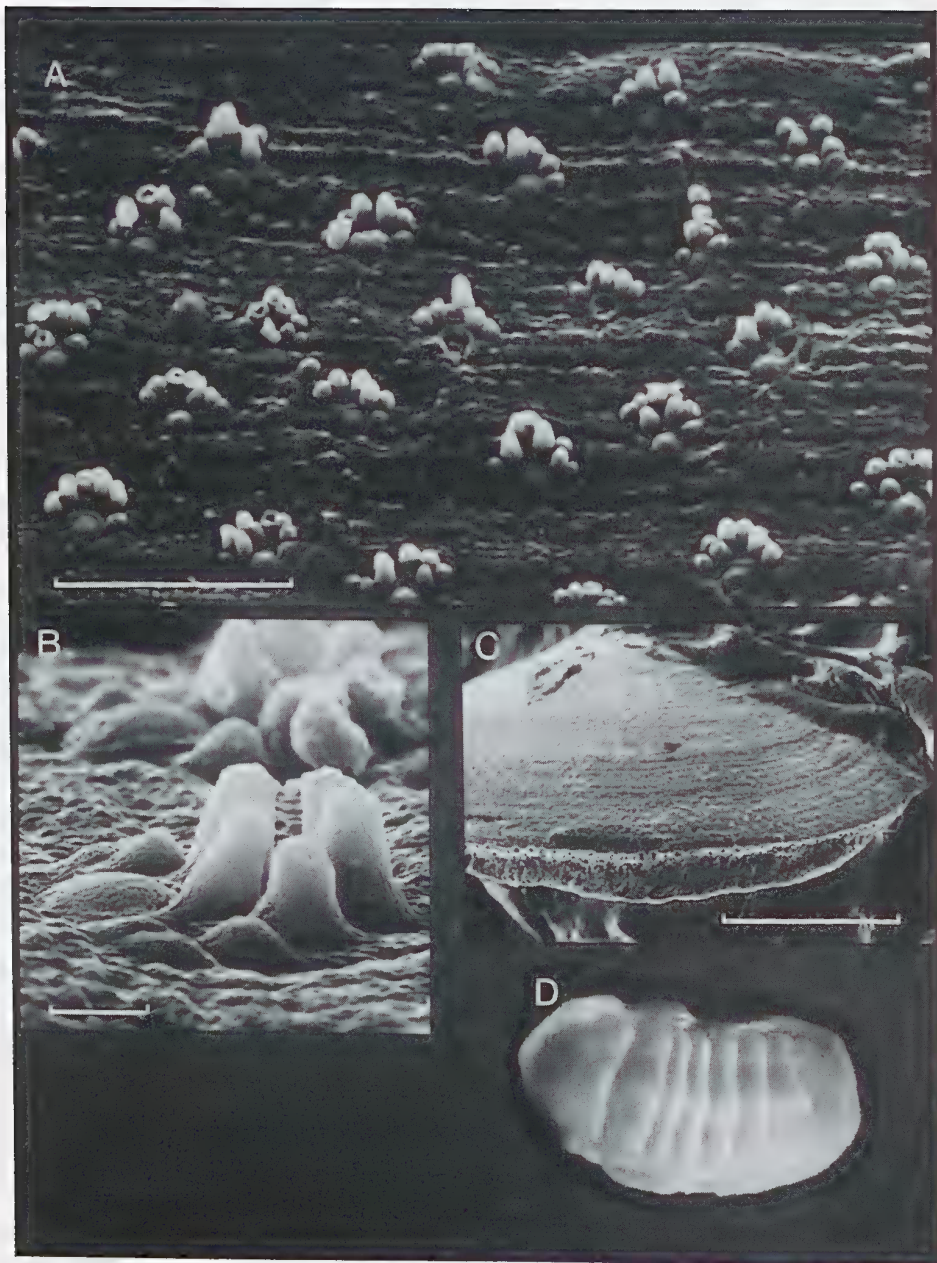


Figure 3. *Xylochiton xylophagus* sp.n. paratypes (RSM-NMSZ 1991055) **A.** detail of tegmentum showing evenly distributed aesthete groups, scale bar = 100 μ m; **B.** detail of single aesthete group, scale bar = 10 μ m; **C.** anterior valve (anterior view), showing corrugated insertion plate and evenly distributed aesthete groups, scale bar = 1 mm; **D.** deformed juvenile specimen with left side of valves 7 & 8 fused, x 10.

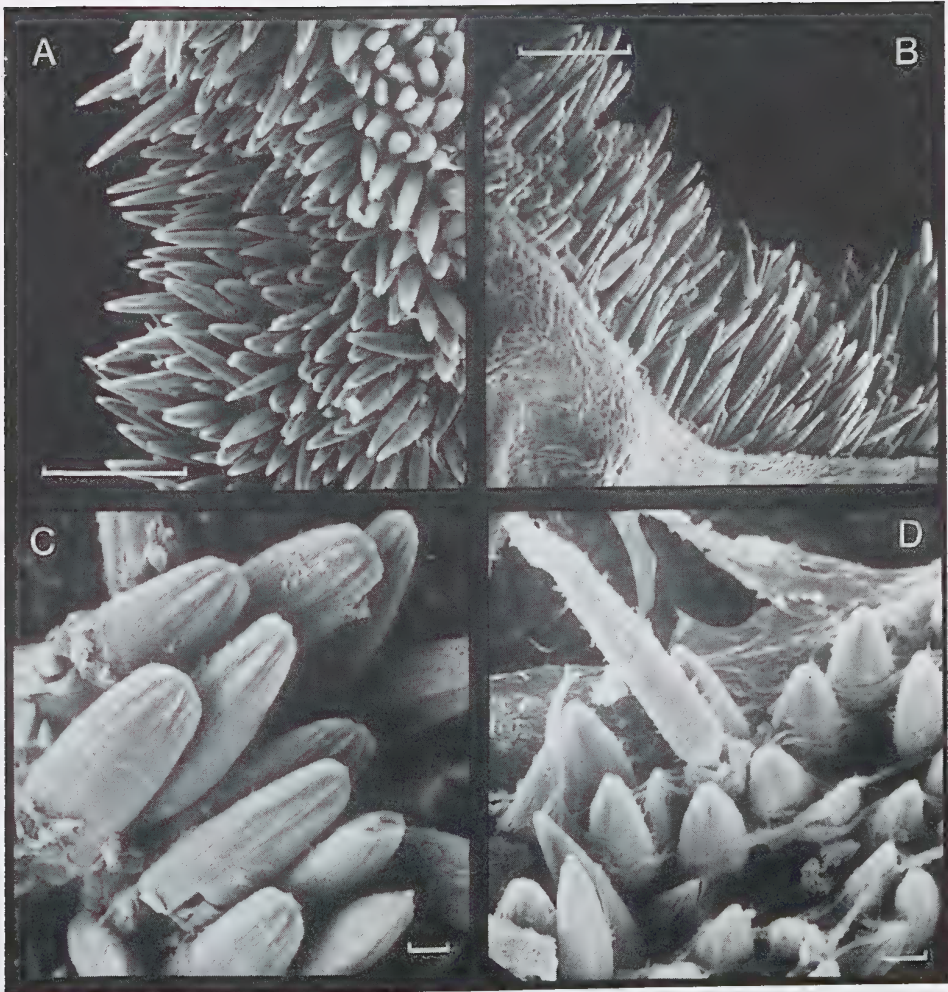


Figure 4. *Xylochiton xylophagus* sp.n. paratype (RSM-NMSZ 1991055) **A.** dorsal girdle spicules, scale bar = 100 μm ; **B.** ventral view of edge of girdle, showing dense spicules dorsally and naked ventral surface, scale bar = 100 μm ; **C.** detail of dorsal girdle spicules, showing grooved tips, scale bar = 10 μm ; **D.** detail of longer hair-like spicule, scale bar = 10 μm .

Narrow, unslit but corrugated insertion plate (Figs 2D, 3C) present around entire anterior margin, wider laterally. Intermediate valves (Fig. 2B) weakly beaked, posterior margin straight to slightly convex, anterior margin concave. Valve areas not differentiated. Tegmentum smooth except for projecting micraesthete caps and weak concentric growth lines, stronger toward posterior margin; aesthete groups as on anterior valve. Sutural laminae well developed, articulamentum extending posteriorly from sutural laminae to form small, weak, unslit insertion plates (Fig. 2E). Posterior valve (Fig. 2C) tegmentum semicircular, almost twice as wide as long. Antemucronal area sculptured like intermediate valves; mucro smooth,

central; postmucronal slope not steep, concave, sculptured like intermediate valves. Sutural laminae well developed; articulamentum extending posteriorly to form thickened, corrugated callus under entire posterior margin (Fig. 2F).

Girdle (Fig. 1A) somewhat fleshy, encroaching slightly at valve sutures; dorsal surface densely spiculose (Fig. 4A) with numerous, flattened, mostly smooth, boat-shaped spicules (50–85 μm long, 15–23 μm wide), tapering to a flattened, blunt point with 2–4 strong ridges on each side (Fig. 4C), concave side toward valves, longest spicules at outer edge of girdle, and with random, sparse, smooth, longer (up to 240 μm long), round, hair-like spicules (Fig. 4D), 10–12 μm wide at base, gradually tapering to a thin, flexible, sometimes bifid, filament apically, each round spicule on short, thin (2–3 μm wide) stalk. Girdle with no calcareous ornamentation ventrally (Fig. 4B).

Gills merobranchial, abanal, 19–21 large ctenidia on each side, tapering large to smaller anteriorly.

Radula (Fig. 5A) with elongate, almost rectangular central teeth, wider apically, with median ridge from base widening to cover all of slightly concave apical edge of head; first lateral teeth narrow basally, with broadly triangular heads, apical edge irregular with broken appearance; major (second) lateral teeth elongate, narrow basally, with wide, tricuspidate heads, central cusp longest, twice as long as outer cusps; third lateral teeth narrow basally, with very broad, strongly curled, comb-like heads (Fig. 5B).

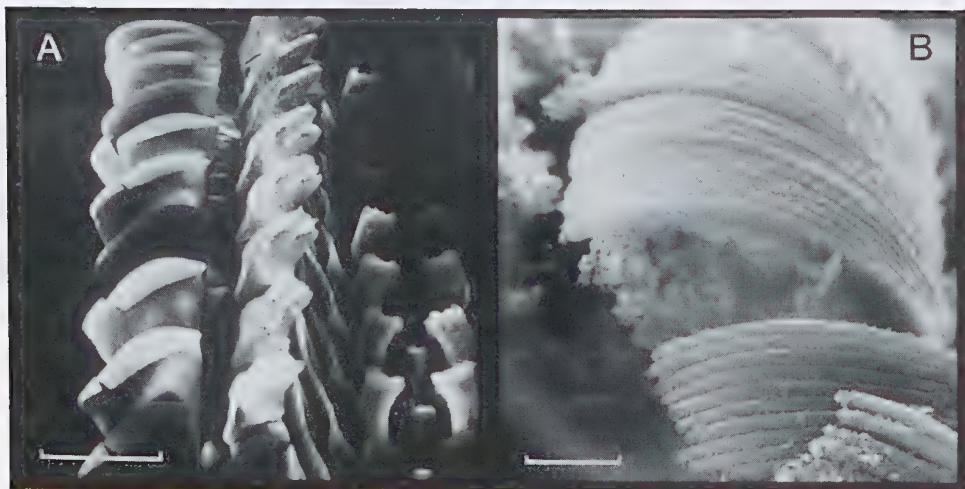


Figure 5. *Xylochiton xylophagus* sp.n. paratype (RSM-NMSZ 1991055) A. radula, scale bar = 100 μm ; B. detail of comb-like head of third lateral tooth, scale bar = 10 μm .

Etymology

From a combination of the Greek “xylos” meaning wood, and “phagos” meaning eating, in recognition of the habit of this species to ingest the sunken wood on which it lives.

Distribution

Waters west and east of North Island, New Zealand, and to the northeast of the Chatham Islands.

Habitat

On waterlogged, sunken wood, particularly Tree Tutu (*Coriaria arborea*), in depths of 1045–1180 m, with a single, very juvenile, specimen (NMNZ M.84251) from 450–481 m depth.

Remarks

One juvenile paratype (RSM-NMSZ 1991055) (Fig. 3D) has the left side of valves 7 and 8 fused. Whether this deformity is due to damage or a genetic abnormality could not be determined.

DISCUSSION

The similarities between members of the Abysochitonidae and Xylochitonidae raise some interesting questions. The divisions in the higher systematics of the Polyplacophora are currently based mainly on the absence or presence and form of the insertion plates, with other features of secondary importance, if considered at all. The members of these two families of deep-water, wood-living chitons are very similar in appearance, and are the only known chitons which lack any calcareous armament on the ventral girdle. Both families also possess a broad, spatulate, comb-like third lateral tooth on the radula. The erect subsidiary caps in the aesthete groups are very distinctive in Xylochitonidae, but there is a suggestion that these may also be present on the periphery of the valves of *Ferreiraella caribbensis* Sirenko, 1988, the type species of that genus (see Jones and Gowlett-Holmes, 1992). However, the Abysochitonidae lack insertion plates totally, whereas in Xylochitonidae, there is a distinct, unsplit insertion plate on the anterior valve, small, weak insertion plates on the intermediate valves and a callus on the posterior valve; under the current classification the presence of these insertion plates must be regarded as a major difference. The main question to be resolved is whether these two families are showing convergent evolution due to specialisations for their habit of living on, and eating, sunken wood in deep water, or whether they are in fact closely related, thus throwing into question the significance of currently used classification criteria. To answer this question properly would require a detailed study and re-evaluation of the relative importance of characters currently used in the higher classification of the whole class, which is obviously beyond the scope of this paper. However, we believe that all of the currently proposed higher classifications, such as those of Starobogatov and Sirenko (1975), Sirenko and Starobogatov (1977), Van Belle (1983, 1985) and Dell'Angelo and Palazzi (1989, 1991), are based on too narrow a suite of characters, and until the character base is expanded to include features that are currently ignored, such as anatomy and valve microstructure, the higher classification will remain unwieldy and in a state of flux.

As more deep-water chiton species are discovered and examined in detail, we hope the relationship between the Abysochitonidae and the Xylochitonidae and between these and other chiton families will become clearer.

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